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NEW ELECTRIC LOCOMOTIVES FOR THE FRENCH STATE RAILWAYS  
(S.N.C.F.)

The locomotive of the prototype CC 6001, which has just been delivered to the S.N.C.F. by the group "Le Matériel de Traction Electrique" (Schneider - Jeumont - Le Matériel Electrique S.A.) is the first one of this type constructed in France for main line service. It has been designed to haul heavy trains over high graded lines, in particular on the sector Limoges-Montauban, in which many grades of 100/00 are encountered for distances of almost 20 Km. The diagram (Fig. 1) indicates the main characteristics of this locomotive which, being provided with six motored axles of 20 tons axle load, can therefore furnish a very high tractive effort.

These six axles are divided between two trucks of which the frames are completely welded, which is the first experience of this type of construction in an electric locomotive. The main girders and cross-beams of the trucks have a tubular section and are assembled by welding, thus forming a solid block possessing great rigidity. The traction motors are of the axle-hung type and engage the corresponding axles with two-sided gearing and spring gears.

Both trucks are coupled by cap and ball arrangements provided firstly with vertical springs which act as an anti-tipping device, and secondly by lateral springs which are meant to facilitate the running on curves. The latter is, moreover, improved by a lateral play of about 15 mm. with return springs with which the first outer axle of each truck is supplied, and by a decrease in thickness of 10 mm. of the flange of the centre axles. Finally, a device has been provided consisting of lateral pins loaded with helical springs in order to minimise lateral vibration.

The cab itself is also entirely welded and rests on either truck by means of a centre pin which is situated at the rear end and joined by two lateral elastic supports which are judiciously placed in the same transverse line and further one elastic support under the cab which is situated at the foremost end of the truck and designed to avoid tilting of the latter. The cab contains a driving compartment at either end; one central compartment has been

provided between the driving compartments and is intended to hold the electrical and pneumatic equipment. The two driving compartments are linked by a central corridor which gives access through lockable doors to the various boxes containing the equipment.

The electrical equipment is of quite a modern type and is entirely automatic. It has already been put to the test in high-speed petrol cars which have recently been delivered. Its application in this case (the first to be used in a high-powered locomotive) has been necessitated by the need for assuring as quick starting as possible. This has led to the inclusion of a great number of starting notches, manual control of which would take too much time. This equipment comprises three separate cam switches, which are controlled by an electric servo motor, and each of which acts on a group of switches playing a clearly-defined rôle in the traction motor circuit. This equipment is further supplied with a hand control which can be used in case of a breakdown of the control circuit.

All circuits are protected by a rapid-action switch of the Alsthom type.

Moreover, the locomotive possesses three motor compressor sets and two motor generator Flower sets, each comprising a generator to energise the motor field windings when driving in recuperation connection.

Finally, the locomotive is supplied with a Westinghouse brake equipment, with dual control with a mechanical brake-cock for equalising discharge and triple valves. It is noteworthy that all conduits fastened to this brake-cock in both driving compartments are grouped in a cast column called a "brake-bloc". This facilitates access to this part of the driving compartment and also the dismantling of the various apparatuses in this part of the brake equipment. The brake is completed by a straight brake and a hand brake, as well as by electric dynamic braking during recuperation, permitting decrease of speed to any rate desired during the descent of long grades.

During the test drives, it was possible to verify that the locomotive easily fulfils all requirements of the specification and especially the hauling of a goods train weighing 1200 metric tons at a speed of 45 K/PH on a grade of 100/00 and the hauling of a passenger train of 750 metric tons on the level at a speed of 105 K/PH. During the latter tests, it was possible to attain a speed of 125 K/PH. Moreover, the stability of the locomotive on the line is excellent at high as well as at moderate speeds.

The locomotive BB 8001 (this locomotive was formerly numbered 0401) is a prototype which incorporates many innovations in respect of the locomotives of the BB type hitherto constructed. A very large number is to be manufactured for the Paris-Lyons line, when this is electrified.

The main characteristics of this locomotive are shown in the diagram (Fig. 2). Its dimensions do not vary greatly from those of the previous BB type locomotives, but it is considerably higher-powered, (2400 HP). On the other hand, the maximum safe speed, in principle fixed at 105 K/PH, has been increased during the trial runs to 115 K/PH with a train of 900 metric tons consisting of passenger cars.

Both of the two trucks are of an entirely welded construction (for the first time in a BB type locomotive). Girders and cross-beams are in tubular form and make a very rigid structure. Further, the axle boxes, which are of the usual type used in such locomotives, are connected to the truck frame by a "silentbloc" device without the gliding surfaces which are normally used in this type of locomotive. These axle boxes are supported at the base by semi-elliptical springs, combined with helical springs. The traction motors are nose-suspended, fixed at one side to the central cross-beam of the truck and at the other side supported by axle bearings of the sleeve type, force lubricated by an oil circulation pump. Double-sided gearing with spring gears is applied.

The trucks are coupled by a centre bar furnished with a pile of discs of the "Belleville" type, also being provided with lateral supports in order to minimise oscillation.

The cab rests on the trucks by means of a centre pin and two lateral elastic supports called "equilibrators". The centre pin is of an entirely new type, comprising a vertical stump with a half-spherical surface at each end, capable of moving transversely about 30 mm. in both trucks and also longitudinally in one of the trucks against reciprocating spring action, in order to ensure correct running on curves.

The cab construction is quite unique : it is assembled by welding together five distinct parts which are constructed separately, thus giving a remarkable flexion strength. It consists of a central compartment housing the electrical and pneumatic apparatus, with a driver's compartment at both ends. A lateral corridor connects these two compartments, also giving easy access to the apparatus behind rolling doors. These are arranged



very ingeniously, being grouped in "blocs" separately assembled, each being assigned a distinct function. The main bloc, situated in the centre, contains the line switches, starting switches and the starting resistors. Similarly, a bloc corresponding to each motor is incorporated, containing the reverser, the cut out switch, the field shunt switches and resistors. All these blocs can be dismantled by way of the cab roof, which consists of three portions, the centre part being the largest.

A special study of ventilation has been made, this being provided by two groups of motor blowers, each suspended on a structure which is removable through the extremities of the roof. These blowers supply cooling air to the traction motors on the one hand, and on the other hand to the central compartment, keeping up a slight over-pressure to keep out dirt or snow, while at the same time supplying cooling air to the starting resistors.

The traction motors are fitted with a compensation winding permitting operation under good conditions with an extremely high percentage of field shunting, which has never been achieved before with a traction motor for a locomotive of the BB type.

The electrical equipment, comprising electro-pneumatic switches of the conventional type (although a very favourable feature has been introduced into the attachment) is protected by an ultra-rapid action switch of the Alsthom type. It should be stated, however, that only two motor combinations can be selected on this locomotive : series or series parallel connection.

Finally, the locomotive is furnished with a dual control air brake of the Jourdain-Monneret type, with a mechanical equalising discharge cock and triple valves, combined with a straight brake and a hand brake. It should be noted that the "bloc-brake" has been installed, as with the preceding series of BB locomotives. The requisite compressed air is supplied by two motor compressors.

The trial runs of this locomotive in hauling a 940-ton passenger train have shown good running performance at all speeds : on level a maximum speed of 110 K/PH has been attained, and on a 8°/100 grade a speed of 57 K/PH, which achievements are far superior to those of the preceding series of BB locomotives.

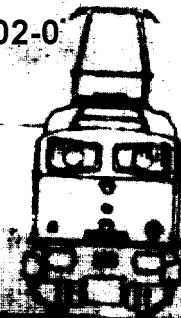
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Fig. 1 - Electric locomotive CC 6001

Lateral play :  $\pm 15$   $\pm 10$  decreased flange thickness.  
 Total weight : 120 t.  
 Adhesion weight : 120 t.  
 Weight per running metre between supports : 6,45 t.  
 Weight per running metre between extreme axles : 8,9 t.  
 Service : Universal  
 Minimum curve radius : 80 m.  
 Maximum operational speed : 105 K/PH  
 Continuous rating at 1350 volts : 3300 HP  
 Hourly rating at 1350 volts : 3780 HP

Fig. 2 - Electric locomotive BB 8001

Total weight : 92 t.  
 Adhesion weight: 92 t.  
 Weight per running metre between supports : 7,1 t.  
 Weight per running metre between extreme axles : 10,3 t.  
 Service : Universal  
 Minimum curve radius : 80 m.  
 Maximum operational speed : 105 K/PH  
 Continuous rating at 1350 volts : 2400 HP  
 Hourly rating at 1350 volts : -



Rayon minimum d'insolation par minute	200
Vitesse minimum de rotation	100 tours
Puissance continue sous 1.500 volts	100 watts
Puissance d'allumage sous 1.500 volts	100 watts

Fig. 1. - Locomotive électrique modèle CC 6001 (Belgique)

Fig. 2. - Explanatory diagram (Diagram)

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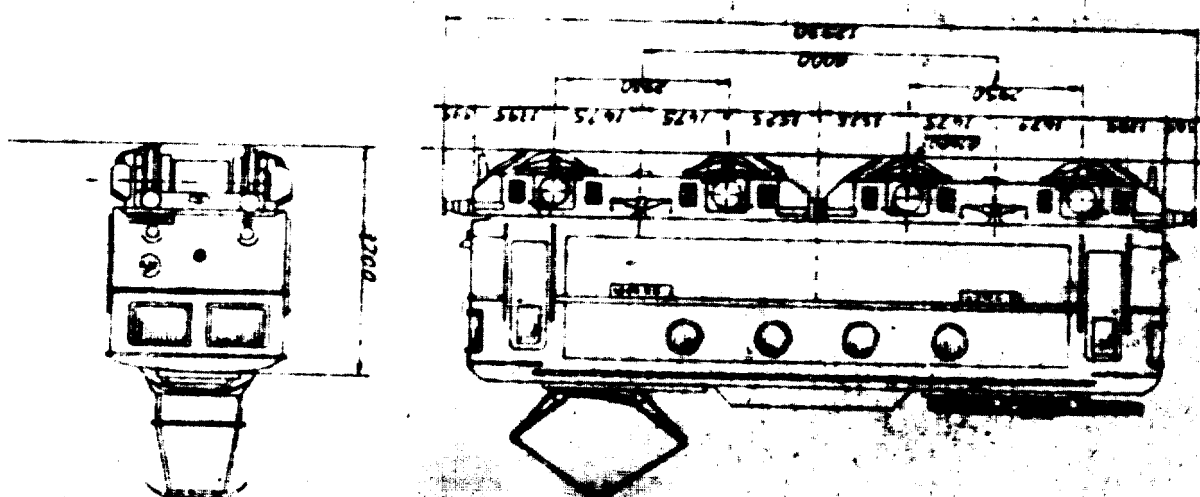




Fig. 3 — Locomotive électrique mixte CC 6001

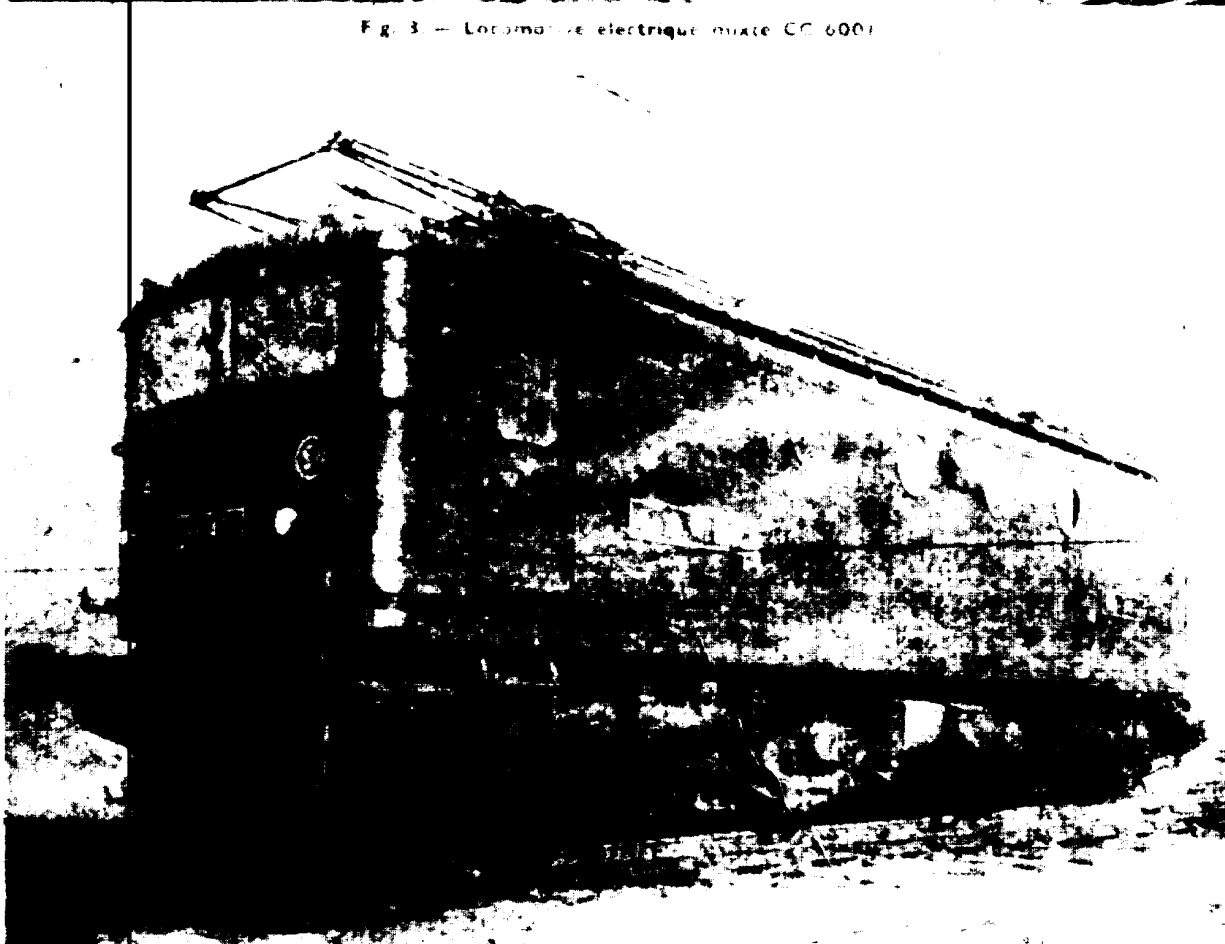


Fig. 4 — Locomotive électrique mixte BB 8001